DOCUMENT RESUME

ED 462 606 CE 083 061

AUTHOR	Knuckey, J.; Lawford, L.; Kay, J.
TITLE	Information Should Be Visual: New and Emerging Technologies and Their Application in the VET Sector for Students Who Are Deaf and Hard of Hearing.
INSTITUTION	National Centre for Vocational Education Research, Leabrook (Australia).
SPONS AGENCY	Australian National Training Authority, Melbourne.
ISBN	ISBN-1-74096-007-6
PUB DATE	2001-00-00
NOTE	44p.; Study was conducted by researchers from the Centre of Excellence for Students Who Are Deaf and Hard of Hearing, Faculty of Further Education, and the Northern Melbourne Institute of TAFE and coordinated by Judie Kay, Janice Knuckey, and Lorna Lawford.
AVAILABLE FROM	National Centre for Vocational Education Research, 252 Kensington Road, Leabrook, South Australia 5068, Australia (Cat no. 719: $22.55 Australian). Tel: 08 8333 8400; Fax: 08 8331 9211; e-mail: vet_req@ncver.edu.au; Web site: http://www.ncver.edu.au. For full text: http://www.ncver.edu.au/research/proj/nr8005.pdf.
PUB TYPE	Reports - Research (143)
EDRS PRICE	EDRS Price MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Access to Education; Accessibility (for Disabled); *Assistive Devices (for Disabled); *Communication Aids (for Disabled); *Computer Uses in Education; Educational Environment; Educational Innovation; Educational Technology; Electronic Mail; Foreign Countries; *Hearing Impairments; Postsecondary Education; Technical Education; Technological Advancement; *Vocational Education
IDENTIFIERS	*Australia; Internet Relay Chat; TAFE (Australia)

ABSTRACT

A project explored deaf and hard-of-hearing students' current use of new and emerging learning technology in technical and further education (TAFE) institutes across Australia. Findings indicated that new learning technologies aided communication, especially when e-mail and Internet chat are used; built self-esteem through self-directed learning; assisted in presenting classroom data through use of electronic whiteboards; enabled use of word processing programs to improve spelling and grammar; and increased the potential for visual information to be made available in the classroom through use of data projectors. New learning technologies were a barrier because of the high level of English literacy needed to access Web sites and CD ROMS; increased number of points in a room on which students have to focus to access information; the physical arrangements of computer rooms inhibit communication between deaf and hard-of-hearing students due to the computer creating a visual barrier; low level of awareness of TAFE staff in the use of new learning technologies with deaf and hard-of-hearing students; high cost of purchasing suitable equipment; and invisibility and low incidence and consequent low priority given to these students by institute management. Recommendations were made for students, teachers, managers, and the VET system as a whole. (Contains 44 references.) (YLB)

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Information should be visual

New and **emerging technologies** and their **application** in the **VET sector** for **students** who are **Deaf** and **hard** of **hearing**

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ISBN 1 74096 006 8 print edition

ISBN 1 74096 007 6 web edition

TD/TNC 68.03

Published by NCVER

ABN 87 007 967 311

252 Kensington Road, Leabrook, SA 5068
PO Box 115, Kensington Park, SA 5068, Australia

www.ncver.edu.au

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Acknowledgements

This study was undertaken by researchers from the Centre of Excellence for Students who are Deaf and Hard of Hearing, Faculty of Further Education and the Northern Melbourne Institute of TAFE. The project was co-ordinated by Judie Kay, Janice Knuckey and Lorna Lawford.

The Centre of Excellence for Students who are Deaf and Hard of Hearing has Statewide responsibility in Victoria for increasing the awareness of the needs of students who are Deaf and hard of hearing within the VET sector.

The researchers would like to thank the following members of the Reference Group:

- John Lovett, Independent Deaf Community Representative
- Robyn Logan, One-to-One Education Consulting, Victoria
- Claudia Slegers, Centre for International Research on Communication and Information Technologies at RMIT University
- Veronica Pardo, LaTrobe University, Victoria

Special thanks to Barry Golding and Libby Hughes for support and assistance and to Kimelle Chapman for typing of transcripts and interpreting when needed.

Executive summary

This project explored Deaf and hard of hearing students' current use of new and emerging learning technology in a range of technical and further education (TAFE) institutes across Australia. There is a growing use of learning technology in TAFE institutes and many more students are using technology to gain access to their studies and to enhance their participation in TAFE. However, there is little research studying the use of technology by students who are Deaf and hard of hearing.

Specifically, the study aimed for Deaf and hard of hearing students in VET learning contexts to:

- identify barriers to the introduction and effective use of new learning technologies
- identify learning technologies that are currently being utilised
- review the appropriateness of these technologies
- identify issues relating to the introduction and use of new learning technologies
- identify issues and implications for the use of learning technologies particularly in relation to infrastructure requirements, staff development and resource allocation
- identify best practice models for use of new technologies

It was found that while Deaf and hard of hearing students were using the learning technologies to aid them in their studies, significant barriers exist in their implementation and use.

New learning technologies for Deaf and hard of hearing students:

- aided communication, especially when email and Internet chat are used
- increased in building self-esteem through self-directed learning
- assisted in the presentation of classroom data through the use of electronic whiteboards
- enabled the use of word-processing programs to improve spelling and grammar
- increased the potential for visual information to be made available in the classroom through the use of data projectors

New learning technologies for Deaf and hard of hearing students were a barrier because of:

- the high level of English literacy needed to access the web sites and CD ROMs
- the increased number of points in a room on which Deaf and hard of hearing students have to focus to access information (i.e. the interpreter, the whiteboard and the computer screen)
- the physical arrangements of computer rooms, which inhibit communication between Deaf and hard of hearing students due to the computer creating a visual barrier between them
- the low level of awareness of TAFE staff in the use of new learning technologies with Deaf and hard of hearing students
- the high cost of purchasing suitable equipment
- the 'invisibility' and low incidence of Deafness and the consequent low priority given to these students by institute management

1: Introduction

Context for Deafness and hearing impairment

In 1999, the National Centre for Vocational Education Research (NCVER) found there were 7366 students enrolled in vocational education and training (VET) across Australia who self-identified on their institute enrolment form that they had a 'hearing disability'. These students had enrolled in 54 775 modules. Almost half of these module enrolments were in three discipline areas: administration/business/economics/law; social/education/employment skills; and mathematics/computing. The other half of these module enrolments was spread across the other ten discipline groups (see attachment 1 for full details).

These statistics gave no indication of what degree of hearing impairment the students have and what support or alternative teaching methodologies, if any, are needed by these students in order for them to complete their studies successfully. Usually, the support needed is arranged by individual institutes who employ disability officers who are responsible for organising appropriate support for all students with a disability. For most students with a hearing loss, the most effective support is usually provided through Auslan (Australian Sign Language) interpreters and/or note-takers.

The Australian Bureau of Statistics (ABS 1996) estimated that there were nearly one million Australian people who experienced a hearing impairment. Most Australians with normal hearing define a hearing impairment as a disability. It is true that most Australians who are hard of hearing commonly view their hearing loss as a disability and identify with the hearing mainstream for social and emotional support (Carty 1993; Lane 1995). However, there is also another group comprising around 15 400 people (Hyde & Power 1991) who see their Deafness not from a medical model but from a 'social construct model'. This group of people forms the Australian Deaf community.

The Australian Deaf community, like other Deaf communities around the world, challenges the medical model of Deafness (Padden & Humphries 1991). They argue that Deaf people have a 'different centre' to that of hearing people, and this is unrecognised or ignored by society in general. This different centre is because Deaf people have their own sign language and culture. Deaf people do not identify with other disability groups, and see their own Deafness not as a disability but as a positive characteristic of themselves—one which gives them entrance into the Deaf community which they define as a cultural and linguistic minority (Australian Association of the Deaf nd).

The Australian Language and Literacy Policy (Dawkins 1991) recognises that:

> *... signing Deaf people constitute a group like any other non-English speaking language group in Australia, with a distinct sub-culture recognised by shared history, social life and sense of identity, united and symbolised by fluency in Auslan, the principal means of communication within the Australian Deaf community* (p.20).

The Australian Deaf community is not a homogenous group as regards to audiological degree of hearing loss. However, they are homogenous in that they define themselves as Deaf with a capital D. Deaf people, as consistently capitalised in this report, use Auslan. They have their own culture, values and life experiences and exhibit distinctive behaviours; for example, being thrilled to have a Deaf baby which distinguishes them from people who have a hearing impairment and who use speech and lipreading to communicate. The critical feature of

belonging to the Deaf community is choice of language (Komesaroff 1994, p.16). It is also defined by attitudes and behaviours (Higgins 1980; Lawson 1981).

Sacks (1989, p.127) illustrates the cultural linguistic construct of Deafness when he writes of his experience at Gallaudet University in the United States (US), the only university for the Deaf in the world.

> *I had to see (an) absolutely silent mathematics department at work: to see Deaf bards sign poetry on the campus, and the range and depth of the Gallaudet theatre; I had to see the wonderful scene in the student bar, with hands flying in all directions as a hundred separate conversations proceeded—I had to see all this for myself before I could be moved from my previous 'medical' view of Deafness (as a 'condition', a deficit, that had to be treated) to a 'cultural' view of the Deaf as forming a community with a complete language and culture of its own.*

This study

In undertaking this study, the researchers have reflected on Sacks's words and have endeavoured to take the approach that use of new technologies by Deaf and hard of hearing students in vocational education and training is not simply to be viewed as a way of compensating for a deficit that may occur due to Deafness.

Australian literature focussing on the use of new technologies to enhance training opportunities for Deaf and hard of hearing students is very limited. What does exist tends to focus on a deficit model of compensation for disability. For example Downie (1996) evaluated new and emerging technologies for people with disabilities and focussed on adaptive hearing equipment for people who are Deaf or hard of hearing. It is for this reason, and because of approaching the study from a cultural and linguistic perspective, that the study has made no attempt to explore the use of assistive listening devices which may be used by hard of hearing students and which may be defined as learning technology by some people.

It should be made clear from the beginning that Auslan is not signing in English word order. Auslan uses its own grammar and for some signs there is no English equivalent and vice versa. Because Deaf people use Auslan as a first language, they read and write English as a second language. For this reason, members of the Deaf community often come to education and training using written English as a second language with varying degrees of proficiency. As a result of a number of years of research, The Centre of Excellence for Students who are Deaf and Hard of Hearing at Northern Melbourne Institute of TAFE (NMIT) states in its Strategic Plan (NMIT 1995) that:

> *... the major barriers that Deaf and hard of hearing students experience in vocational education and training are most often related to language, communication and support issues.*

This study specifically addresses language and literacy problems, on the grounds that Deaf and hard of hearing students are more likely to face a compounding of barriers to both technology and the content being developed for technologically based modes of delivery.

Objectives of the study

Due to the increasing use of technology in education, particularly for the purposes of this study in the vocational education and training sector, it is important that the needs of equity groups are not overlooked. Deaf and hard of hearing is one equity group which has specific communication needs which may be addressed by appropriate application of information and communication technologies. Effective use of these technologies has the potential to greatly enhance and extend educational and training opportunities for Deaf and hard of hearing learners.

However, the technology used in the teaching and learning process must be used sensitively, bearing in mind the specific communication and language needs of Deaf and hard of hearing learners. It is therefore important to investigate:

- what technologies are currently being used by Deaf and hard of hearing learners
- how effective and appropriate this use is
- what barriers may exist to its use
- ways in which this use may be improved

The study was undertaken in order to begin to build a picture for policy-makers, planners and practitioners so that they can look at ways of improving training and educational opportunities for Deaf and hard of hearing students through better use of information and communication technologies.

This study took place in an Australian context of TAFE providers in 1999. The study aimed for Deaf and hard of hearing students in VET learning contexts to:

- identify barriers to the effective use of new learning technologies
- identify learning technologies that are currently being utilised in the VET sector
- review the appropriateness of these
- identify issues relating to the introduction and use of new learning technologies
- identify issues and implications for the use of learning technologies particularly in relation to infrastructure requirements, staff development and resource allocation
- identify best practice models for use of new technologies

Definitions

It is important from the outset to be clear and consistent about the meaning and definitions of terms used throughout the report. The definitions are divided into two sections—terms relating to Deafness and education and terms relating to learning technology.

Terms relating to Deafness and education

- *The capitalised term 'D' for Deaf* denotes those people who have any degree of hearing loss from mild to profound, and who:
  - identify with the Australian Deaf community
  - share the same visual language (Auslan)
  - have common cultural beliefs, values and life experiences

  (Ozolins & Bridge 1999; Lane 1999; Power 1996)
- *The Australian Deaf community* comprises Deaf people in Australia who share a sign language, cultural values and similar life experiences (Ozolins & Bridge 1999). It is estimated that there are approximately 15 400 members of this community in Australia (Hyde & Power 1991; Power 1992).
- *Deaf* with an uncapitalised 'd' denotes those people who are severely and profoundly deaf but who prefer to communicate using speech and lipreading. In general, they do not identify with Deaf people as defined above. The term is also used when speaking about an audiological degree of hearing loss (Ozolins & Bridge 1999; Lane 1999; Power 1992).
- *Hard of hearing* is defined as those people who have enough residual hearing to communicate with speech and lipreading. Their hearing losses are generally mild to moderate. They identify with the hearing community and not with the Deaf community (Ozolins & Bridge 1999; Lane 1999; Power 1996).
- *Auslan* is the visual language of the Australian Deaf community. Auslan consists of hand signs and letters spelt on the hands which combine, along with distinct grammatical patterns and specific linguistic features, to produce a complete language which is

recognised world wide as a distinct language in its own right. There is no written form of this language (Johnston 1989).

- *Interpreters* are people who are fluent in both sign (Auslan) and spoken language. They interpret sign into spoken language and vice versa. Interpreters convey communications between a hearing and a Deaf person.
- *Vocational education and training (VET)* subsumes the public *technical and further education (TAFE)* sector in Australia. It is offered through Commonwealth, State and Territory public, private and community systems of post-secondary education and training providers. It is generally seen, through its vocational focusses, to be linked directly to the needs of business and industry. The national system operates according to a set of shared principles and agreements, including the National Strategy for Vocational Education and Training and the Australian National Training Authority (ANTA) Agreement.

Terms relating to learning technology

- *New technology* as used in this report refers to the use of computers, compact disk read-only memory devices (CD-ROMs), the Internet (including email and the World Wide Web) and other electronic equipment used as information, learning and communication tools.
- *Learning technologies* are any new technology as defined above which is used in the classroom to aid learning.
- *Personal computer (PC)* refers to a medium-sized computer which is used mainly by people working at a desk.
- *Teletypewriter (TTY)* consists of a keyboard, a visual display and a modem. By dialling the required number another TTY can be contacted and by typing on the keyboard and reading the visual display, communication can take place via the normal public telephone network (PTN).
- *CD-ROM* is a compact disc with read-only memory on which information is stored for use by a computer, but which cannot be changed.
- *WWW or World Wide Web* is a system operated over the Internet, in which information is accessed via a browser.
- *Email* is a system of using computers for sending messages from one place to another. An electronic mailbox is the place where the computer stores the messages.
- *Chat* involves communicating through on-screen print via a computer to another computer user at a different location.
- *Video-conferencing* describes the holding of a conference among people at remote locations by means of transmitted audio and video signals.
- *Data/video projector/show* is an electronic projector which projects images from a computer to a screen.
- *Video relay interpreting (VRI)* is a specific aspect of video interpreting which refers to the use of a video telephone to relay information between a Deaf Auslan user and a hearing person who does not understand Auslan, via a qualified Auslan interpreter.
- *Digital camera* is a camera which records photographs in digital form.
- *Online delivery* is delivery of training using electronic interactive systems via telephone lines to personal computers (PCs).
- *Electronic whiteboard* is a board used in a classroom which, by pressing a button, allows the notes written on the board to be printed out on paper.
- *Bandwidth* denotes the speed and amount of digital information which can be transmitted along telephone lines for video-conferencing and video relay interpreting.

Methodology

- The project began with a national survey of current practice in the use of new technologies in the provision of training to Deaf and hard of hearing students. A one page 'fax back' questionnaire was prepared, requesting simple information about the number of Deaf and hard of hearing students and the types of technologies they used in undertaking their courses. These were mailed to the chief executive officers of 82 TAFE institutes in all Australian States and Territories. Follow-up telephone and fax contact was made with the aim of improving response rates.
- A literature search was conducted to identify both Australian and overseas literature relating to the aims of the research. This drew on three source areas:
  - VET sector planning and policy documents relating to new technology use
  - a World Wide Web survey of major educational institutions and Deaf web sites to assess activity, particularly in the use of online technologies
  - journals and papers about technology use in the VET or equivalent overseas sectors for Deaf and hard of hearing students
- Four TAFE institutes in four different States of Australia were identified for a more detailed study. Initially, selection of TAFE institutes was made where the national survey indicated a higher number of Deaf and hard of hearing students attending (from ten up to 70) and the use of four or more of the new learning technologies listed in the initial survey. The person who completed the survey was contacted either by phone or email to seek permission for the researchers to visit and carry out the interviews. An important selection criterion was to ensure coverage of both metropolitan and rural institutes. The aim in preparing the case studies was to present a detailed picture of how some TAFE institutes incorporated technology use for Deaf and hard of hearing students within the institute infrastructure.
- Interviews were organised with Deaf and hard of hearing students, their teachers and those managing the resources for such programs. A researcher visited these TAFE institutes to conduct and record the interviews. The hearing researchers used qualified Auslan interpreters in interviewing the Deaf students. A Deaf researcher interviewed subjects in Auslan without using an interpreter. In total, 18 interviews were conducted and transcripts were prepared from the tapes. All participating individuals and institutes were guaranteed anonymity.
- All data were analysed to identify the major issues that emerged from the initial surveys and the case studies, in order to make recommendations on:
  - appropriate technologies to be used in the provision of training and education for Deaf and hard of hearing students
  - development of best practice exemplars for the use of new technologies in the training and education of Deaf and hard of hearing students
  - detailing resource implications in the use of new technologies in training and education for Deaf and hard of hearing students

This report relies heavily on case study data from interviews. Interviews conducted specifically for this study enabled researchers to focus on individuals and to recount the details that emerged in a direct manner. The 'story' of how technology is being used by Deaf and hard of hearing students is revealed directly by using the voice of the interviewees. This approach is outlined and justified by Stake (1994), who describes case study as not so much a methodological choice as a choice of object to be studied. The interest is in the individual subject and what can be learned from the individual, rather than on what can be gleaned statistically from a population of cases. In the process of this study each interviewee raised unique issues. The total of issues raised was therefore greatly enhanced by this approach. However, by means of a parallel survey, some common issues were raised, allowing some triangulation with interview data to enable identification of the more common and important issues.

The sample

The heads of 82 Australian TAFE institutes were targeted for a mailed survey. TAFE institute locations and addresses were sourced from the ANTA web site. Recipients were requested to direct the survey to the relevant person in the institute for completion. Most of the 43 responses were from disability officers. The return rate was 52 per cent.

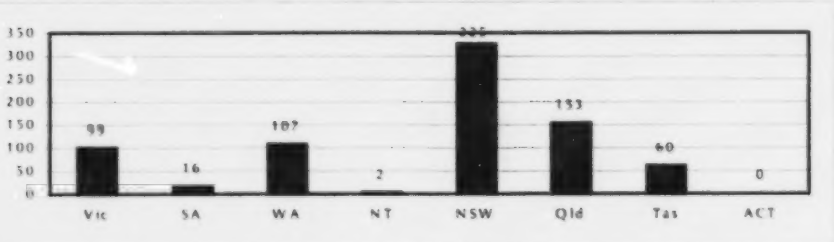
As can be seen from the table below, about half of the institutes surveyed in each of the States and Territories sent replies.

Table 1: Institutional responses by State and Territory

State or Territory	Sent	Returned	Percentage
Queensland	18	7	39
Victoria	17	10	59
Western Australia	15	6	40
New South Wales	12	8	67
South Australia	10	7	70
Tasmania	5	3	60
Northern Territory	4	2	50
Australian Capital Territory	1	0	0
Australia	**82**	**43**	**52**

Figure 1 below indicates the number of Deaf and hard of hearing students identified in States and Territories of Australia. In total, 822 Deaf and hard of hearing students were identified from the survey.

Figure 1: Number of Deaf and hard of hearing students identified by State and Territory



Limitations

This study is subject to six limitations which are important to identify at the outset.

- By overtly locating and researching Deaf issues as issues outside the deficit model, this study takes a cultural view of Deafness which is not necessarily mirrored in VET (specifically TAFE) policy and practice. Indeed, most TAFE institutes continue to deal with Deaf students via a disability model. That is, the communication and language problems experienced by Deaf and hard of hearing students are dealt with not as second language issues as they might be for a non-English-speaking person, but rather as a disability via a disability officer.
- By way of illustration, in the first stage of this project TAFE institute directors were asked to complete a survey about the use of technology by Deaf and hard of hearing students, or direct it to the most appropriate person within the institute. In fact, nearly half (44 per cent) were completed by the disability officer. The remaining surveys were completed either by equal opportunity officers, department managers or teachers. The survey data

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on Deaf and hard of hearing students therefore incorporate many attitudes framed within the disability model. This model does not necessarily represent the philosophy of the Australian Deaf community or the philosophy of Deaf or hard of hearing individuals studying at TAFE institutes.

- Hard of hearing students do not necessarily participate in the Deaf community and so have a different approach to issues raised in the study. Carty (1993) explains, that 'for this group of people hearing loss is viewed as an unfortunate physical condition' (p.4) and therefore the higher priority for them is usually 'adapting to hearing loss' (p.34). This means that they are more likely to identify themselves as a person with a disability rather than a person from a cultural or linguistic minority.
- Returns from some TAFE institutes indicated that they interpreted the survey term 'use of technology' as meaning only those students who were studying a computer technology related course and may not have considered other uses. For example, technologies such as the data projector can be used to aid communication in a classroom setting, or spelling and grammar checkers might be used to assist learners in improving their language skills in an incidental or deliberate way.
- A number of TAFE institutes, initially selected for follow-up interviews on the grounds of having a high number of Deaf and hard of hearing students with good use of technology, preferred not to participate. This occurred for a number of reasons. In some cases the disability officer was new to the position and did not feel able to assist the researchers adequately at the time. Some institutes chose not to participate because they covered such broad geographical areas that it would have been extremely difficult to organise the desired range of interviewees required for the case study. Institutional selection was more about finding institutions that would agree to participate within the time frame necessary to complete the research than random or systematic selection.
- Some Deaf interviewees were unwilling to openly express their views about technology and training issues due to limitations in the communication and interview processes. Despite the best efforts of the researchers, it is still possible that Deaf and hard of hearing students may not want to discuss their study problems freely. In some instances where a hearing person was interviewing using an outside interpreter, the interviewee did not feel comfortable about the communication process and therefore chose to discuss the issues only at a superficial level.
- Some TAFE institutes did not differentiate between theoretical *access* to new technology and actual *use* of that technology by Deaf and hard of hearing students. In effect, there was no indication that Deaf and hard of hearing students were actually using the technology available.

Literature review

Literature on learning in VET for people who are Deaf or hard of hearing

VET sector planning and policy

At the national policy and planning level, there is evidence of some policy intentions constructed outside the disability/deficit model which aim to build a training system that is both accessible and inclusive.

For example, in December 1998 the Commonwealth Government released *A strategic framework for the information economy* which identified national priorities for guiding Australia's transition to the information economy (National Office of the Information Economy [NOIE] 1998). Among the priorities was one that aimed to deliver the education and skills Australians need to participate in the information economy. The vocational education and training sector was identified as playing a key role in this strategy.

The National Office of the Information Economy also suggested that:

> *Governments must have a strong commitment to lifelong learning for all Australians—including people with special needs, such as older workers, people with disabilities and the unemployed—and to the provision of infrastructure and the development of new technological tools and services to support that learning.* (NOIE 1998, p.9)

The ANTA *National Strategy for Vocational Education and Training 1998–2003: A bridge to the future* (ANTA 1998a) underpinned its mission statement with five key objectives:

- equipping Australians for the world of work
- enhancing mobility in the labour market
- achieving equitable outcomes in vocational education and training
- increasing investment in training
- maximising the value of public vocational education and training expenditure

ANTA also stressed the importance and impact of new information and communications technologies on the community in this paper (ANTA 1998a). Two ANTA national strategy supporting papers—*Achieving equitable outcomes* (ANTA 1998b) and *Eyes wide open* (ANTA 1998c)—were published to accompany the ANTA national strategy.

Eyes wide open issues a caution that 'new technologies are not yet and never will be, the complete answer for rural and remote areas and disadvantaged people' (ANTA 1998c, p.4). Tinkler, Lepani and Mitchell (1996, p.24) are sympathetic to that view when they suggest that 'while there are significant breakthroughs in the use of technologies to assist previously disenfranchised groups, much is still needed to be done for the identified equity groups'.

Eyes wide open also questions whether people will have the numeracy and literacy skills to access education and training using these technologies. It asserts that 'technology has the potential to address current inequities of access, so long as issues of infrastructure, costs and instructional design, learning support and cultural relevance are also addressed' (ANTA 1998c, p.4). Other strategies recommended to ensure a more inclusive training system are the need to:

- be effective and innovative in customising training programs and materials to meet client needs in ways which are inclusive and culturally appropriate
- facilitate access to lifelong learning, particularly for those who lack access to appropriate learning environments and those who are training poor (ANTA 1998c, p.4)

A bridge to the future suggests that performance indicators at a national level could support the implementation of these strategies by:

- *creating incentives for registered training organisations to address equity issues, based on a better understanding of the costs associated with delivery to clients with special needs*
- *making use of new technology to broaden opportunities for those living in rural and remote communities or unable to access institutional or work-based training* (ANTA 1998a, p.16)

This critique (ANTA 1998a) makes it clear that equity will be achieved through a whole systems approach for designated groups and that its capacity to respond to a diversity of clients will be measured by outcomes rather than just by participation rates. ANTA promotes a strategic approach aiming to overcome or remove structural inequities and resourcing practices which preclude flexibility in programs and delivery mechanisms.

A report put out by the ANTA Disability Forum in 1999—*Bridging pathways: A national plan of action for increasing people with disabilities in vocational education and training*—does not specifically address new learning technologies. However, it does state that the leaders of vocational education and training will need to co-ordinate and commit themselves to improving participation and success rates for people with disabilities if current inequalities are to be eliminated.

Language and literacy issues in the use of new technologies in the VET sector

A recent ABS survey conducted in 1996 (ABS 1997, p.1) revealed that 6.2 million Australians between the ages of 15 and 74 have 'poor' or 'very poor' prose literacy skills. This clearly impacts both on their employment opportunities and the ability of the industries in which they predominantly work to offer training for them. As can be seen from the studies that are cited below, many Deaf and hard of hearing people are likely to be in this group. It has not been well-recognised that for Deaf people the use of written English locates them in the ranks of English as second language users because their first language is Auslan. Most schools and facilities for the Deaf today do not recognise this and all instruction is given in English either through a manual system (for example finger spelling using English language) or through speech. Thus, Deaf children are expected to learn all curriculum areas through a language in which they are not fluent (Lane 1999). As a result, they acquire literacy levels with different degrees of success. Ozolins and Bridge (1999) cite Strong (1988), who concluded that the reading comprehension skill of Deaf children in America 'was considerably lower than those of hearing children of comparable age. About half of the population of Deaf 18 year olds were reading at or below a fourth grade level and only about ten per cent reading above eighth grade level'.

> *I hadn't even thought of the grammatical differences between Auslan and English. I know the vocabulary must be restricted because we gather vocab, but I had never thought about the grammar and the more complicated structures.* (Mainstream teacher with a Deaf student in the class)

There has been little similar research carried out in Australia, but studies conducted by Walker and Rickards in a report to the Department of School Education in Victoria in 1992 found that Deaf school leavers (15 plus years) achieved an average reading grade level of grade six. Power (1981) surveyed 300 Deaf school students from Queensland, New South Wales and Victoria and found that of students attending a school for the Deaf, only 14% were within their expected reading age.

In 1998, a study was conducted by the Centre of Excellence for Students who are Deaf and Hard of Hearing at Northern Melbourne Institute of TAFE (Knuckey, Kay & Lawford 1998) to test the feasibility of online training for Deaf and hard of hearing VET students. This study concluded that the high reading level required by most World Wide Web sites and CD-ROM training materials was a significant barrier to Deaf and hard of hearing students accessing online learning opportunities.

The issue of language levels of materials produced for online and CD ROM materials being too high for many Deaf and hard of hearing learners has been overlooked in past studies. An example of this oversight was demonstrated in a 1993 study conducted for the then Department of Employment, Education and Training. *An enabling vision* (Kearns & Associates 1993) examines the benefits of open learning for disadvantaged students. One of the key areas of support was seen to be through the use of technology to assist in the delivery of education and training. Kearns suggested that learning barriers are also reduced by the use of modern learning technologies but there was no mention of the need to be conscious of the language/literacy levels of users of technology-based training materials.

> *Many of them, when left to their own devices, aren't confident and aren't prepared to approach the lecturer … they'd prefer to go home.* (Support officer)

On the other hand, a number of researchers and practitioners in the adult literacy field have indicated the value of new technologies in addressing the needs of adult learners. Butler (1997) claims that technology sets up opportunities where 'teachers and students can share in a learning experience which breaks down barriers rather than emphasising them and opens up the possibility for the students to be the directors of their own learning experiences to a far greater extent than has been possible before'.

> *I always talk through the computer to people. That's quicker than watching someone's finger spelling.* (Deaf student)

Daly (1996) concluded that teachers and students in the language and literacy area are well-equipped to work very effectively in the new and exciting textual environment provided by the screen. Javed and Wilson (1998), however, warn that teachers and learners in the adult literacy and basic education field have limited computing resources and training at their disposal and that organisational commitment to provide computers for classroom teaching is usually very limited.

> *We can't afford the-data shows and we don't know how long the technology will last anyway.*
> (Computer teacher with Deaf students in his class)

Hopey (1998) presented a vision of how adult basic education clients in the United States were able to access instructional materials through technology applications. He identified how adult educators attempt to respond to the challenges in adult education of inadequate funding and facilities and suggested that:

> *... by coupling a variety of technologies with new modalities of instruction, adult educators are now providing adults with another chance at basic education, reaching those disadvantaged by limited time, distance, or ability to persist.* (Hopey 1998, p.18)

Again, in a US context, Lovell (1998) claims that technology can help to achieve 'the federal vision for adult basic education learners [by ensuring] access to high-quality instructional materials and to related information resources through technology applications'. The National Literacy Act of 1991 sets forth a vision for a literate society 'to enhance the literacy and basic skills of adults, to ensure that all adults in the United States acquire the basic skills necessary to function effectively and achieve the greatest possible opportunity in their work and in their lives' (Lovell 1998, p.8).

In its statement on equitable outcomes for the VET sector, ANTA's *A bridge to the future* similarly specifies one strategy for the achievement of equity to 'make efficient use of new technology to broaden opportunities for those living in rural and remote communities or unable to access institutional or work based training' (ANTA 1998a, p.16).

Technology use in the VET or equivalent sectors internationally

A reading of selected international papers in the ERIC[1] database revealed a concentration of research activity into the use of technology with Deaf and hard of hearing students in schools and in higher education, but not in the vocational sector. In Kansas, for example, interactive/compressed video has been used in the delivery of school–teacher training programs for Deaf teachers (Luetke-Stahlman 1995). The University of Kansas also used an interactive video for graduate-level Deaf education courses, and found a high degree of satisfaction from students. It concluded that this technology would make graduate courses available to students who otherwise would not have had that opportunity. Research by Mertins and Rabiu (1991) on pre-service Deaf teachers in the US revealed greater comfort and confidence with the subject materials when computers were used as an instructional tool.

In order to gain a picture of practice in the equivalent VET sector in the US, a search of the ERIC Clearinghouse for Community Colleges was conducted using the same search terms of 'Deaf and hard of hearing' combined with 'technology'. In total, 62 papers were located. In general, these did not deal directly with any practice or research specifically in the area under study, although some included references to Deaf and hard of hearing students. The papers revealed a focus on the support needs of these students, thus taking the deficit model approach of using technology to compensate for Deafness, rather than making education and training more accessible in a positive way by using technology to overcome communication barriers.

[1] ERIC, a national education information network, is part of the National Library of Education, US Department of Education.

World Wide Web survey

A search of national and international web sites was undertaken to assess the level of activity in the use of new technologies in the delivery of training and education. It revealed little activity in known major educational institutions catering for Deaf and hard of hearing students.[2] The survey again revealed an emphasis on technology use in the school sector. This activity is not yet mirrored in the post-secondary education sectors in both the US and Australia. Some exceptions, however, are worthy of brief elaboration.

In one particular case reported by McDavid (1999), a School for the Deaf on a university campus in the US was participating in an extension program with the Virtual High School. The aim of this program was to give Deaf secondary school students the opportunity to participate online in a range of activities that would not otherwise be available to them. Deaf students were attracted to this project because of the opportunity it gave them to work independently in more challenging courses. McDavid reported that the major barriers encountered by students were understanding some of the language used and the use of non-captioned movies and sound files.

> *I asked the teacher if she had videos with sub-titles and she thought I was being cheeky.*
>
> (Deaf student)

Another US Project, 'Telecommunications for All' (Gallaudet University 1999), was aimed at schools. This project was designed to introduce new telecommunications technology into schools for Deaf children, including teletypewriters, fax machines, computer projectors, online services and TTY modems. An earlier project conducted by the National Centre for Accessible Media (1999) explored the role of multimedia and videodisc packages in the education of Deaf and hard of hearing students and how existing packages might be made more accessible and understandable to these students. None of these projects, however, extended beyond secondary schooling.

In another example in the web literature, Rochester Institute of Technology in New York auspiced the National Technical Institute for the Deaf (1997) with a broad policy objective to utilise technology for the delivery of courses, but as of 1999 had no active plan in place. Other searches revealed that the University of Bristol in Great Britain has a Centre for Deaf Studies but no strategy for online delivery. Deaf Canada Online had developed a 'web flyer' service that included information about educational opportunities but had no specific online training available. The Royal National Institute for Deaf People in 1999 was trialing technologies such as distance interpreting around the UK, providing a distance interpreting service and enabling Deaf and hearing people in the same location to communicate, using an interpreter who was based elsewhere. However, there was no indication that this would be used for delivery of education and training programs at this stage.

The web search demonstrated that Deaf organisations are currently using information and communications technology as a tool to disseminate information and as a way of making contact with others around the world. However, it also showed that the use of online technologies for delivery of education and training to the Deaf is in its infancy. The only active models in place in 1999 were those at Gallaudet University in the US, which offered Extension and Online Programs for 11 subjects, enabling students to take credit courses towards Bachelors' or Masters' degree courses outside the face-to-face classroom.

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[2] An extensive listing of international sites of college and universities involved in delivering programs to Deaf clients can be found at http://user.chollian.net/~ad21th/kDeafe.htm. Another well-researched list of sites can be found at www.Deaflibrary.org/

2: Presence of learning technologies

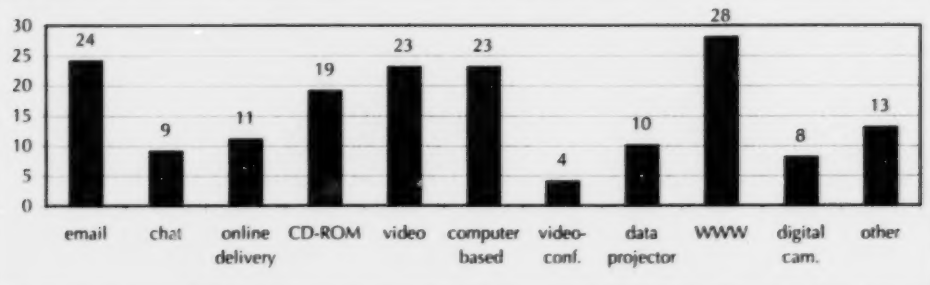
The institutional survey

The survey undertaken as part of this research project was designed to identify as many Australian TAFE institutes as possible that had enrolled Deaf and hard of hearing students. In particular, it set out to give a very general idea of what technology these students were using in undertaking their courses. The aim was to gain a broad picture of technology use but, more particularly, to locate potential sites for the more detailed case studies to follow.

Survey results

Figure 2 below shows the level of use by Deaf and hard of hearing students of each individual type of technology. Survey respondents identified how many Deaf and hard of hearing students were using each type of technology, as indicated below.

Figure 2: Level of use by Deaf students of individual technologies



- The two most frequently available technologies were World Wide Web and email, followed by computer-based training and video. The data do not indicate whether or how these technologies were *applied* in the education and training setting. All that is known from the survey is that they were available to Deaf and hard of hearing students in the institutes that replied to the survey.
- There was a strong correlation between use of email and World Wide Web, with 23 returns indicating that both were used by students in their institutes.
- Chat was not widely used, a situation that could reflect a low level of awareness of this technology. Alternatively, it could reflect the fact that most institutes had 'fire wall' network protection that precluded the easy use of this technology.
- There was no indication as to whether video materials used were captioned.
- Of note is the low use of data projectors, a technology that facilitates a teacher giving a very effective visual presentation for Deaf and hard of hearing students.
- Also of note was the low use of video-conferencing. This is because its benefits are not widely known in the hearing community, despite its widely recognised benefits to the

Deaf community. Another difficulty with this technology is the requirement for higher bandwidth capability, which makes this a very expensive option.

The case studies

Each case study is reported below using pseudonyms. An individual was interviewed from each location. Each has been profiled and the institute's perspective has been documented after each profile.

Case study 1

This study took place in a rural TAFE institute with campuses spread over a wide geographical area. The institute had a total enrolment of over 20 000 students and more than 1000 staff. Deaf students were supported by a person specifically responsible for Deaf and hard of hearing students. This was a system-wide policy, and not one specific to the institute.

Interviews were conducted with:

- two Deaf students and one hard of hearing student
- one teacher/consultant for Deaf and hard of hearing students
- one teacher who has worked with the Deaf and hard of hearing students
- one head of department

Student profile

Reid

Reid was born Deaf and his primary language is Auslan. Reid also has visual problems, which add to the communication difficulties that he faces in a training situation. While his own assessment of his writing skills is very positive, it is not clear at what level of literacy skills he operates. He is unemployed and is not confident of his chances of gaining employment.

Reid lives in a small rural community in which there are no other Deaf people. He has attended a regional TAFE institute for a number of years, studying computer applications in a niche class for students with a range of disabilities. He is not ready to move into a more vocationally focussed study program. Reid prefers to continue to study in a well-supported environment that provides him with valued social contact and an opportunity to increase his skills with technologies that he uses for recreational and social purposes.

Reid is beginning to use email for personal communication purposes. He is theoretically able to email teachers, although has not done this yet. He uses chat forums to make contact with people around the world.

> *I am online to many things in the world. So the Internet is fantastic for me. I have many friends throughout the world who I have met through chat.*

One problem he faces on a limited income is the cost of the Internet Service Provider (ISP) that can be more expensive due to his rural location.

> *I use the Internet a bit at home. It costs money though, so I have to be careful.*

He is able to use the computer to communicate with his teacher in class using Alt/Tab keys to move between message and application, and he says this is a efficient way of asking questions.

> *I can't lip read and I don't have an interpreter. I always talk through the computer to people.*

Reid finds search engines overly complicated and needs help to use them effectively.

Institute profile

The TAFE institute that Reid attends provides a comparatively high level of support for Deaf and hard of hearing students at all campuses. There is a half-time support specialist for Deaf and hard of hearing students, who is able to support Reid and the other 10–15 students enrolled in both the niche class on one campus and broader vocational subjects within the mainstream campuses.

Print resource materials have been prepared specifically for the Deaf and hard of hearing students and they appreciated these texts and indicated that they helped them use the more technical and difficult computer training texts.

> *... and that might mean the student gets extra time to do the test, it might mean rewriting the test, having an interpreter present at the test, having a Reader/Writer/Scribe, whatever ... there's a whole range of things that we can apply for.* (Teacher consultant)

Institute teachers are given extensive support and training for working with Deaf and hard of hearing students in the classroom situation, and there is a culture that demonstrates an understanding of their communication needs. An experienced note-taker is used to support students by assessing what will happen in a particular class. The note-taker then sets up an appropriate way in which the student can participate more effectively. There is also a willingness to support students with appropriate equipment such as large monitors to assist students with visual difficulties. This is different to the approach common in many other TAFE institutes, where the needs of Deaf students are managed via one, non-specialist, support person who does not necessarily have expertise to service to their needs appropriately.

> *I don't have an interpreter in class. I only have the teacher and she can sign a little bit. She is very slow.* (Deaf student)

This system-level and institute support acts to encourage Deaf and hard of hearing students to undertake training. A number of students like Reid are prepared to travel considerable distances and to cross a State border in order to attend. This further seems to result in sufficient numbers of students attending courses and provide the opportunity for social contact and support through group interaction. The presence of a specific support person for Deaf and hard of hearing students provides a focal point around which collaborative activity can occur. Other studies (Knuckey, Kay & Lawford 1998), confirm the critical need for Deaf and hard of hearing students to connect personally with other learners and with their teachers.

Case study 2

This case study took place in a metropolitan TAFE institute with over 20 000 students. While it had several minor campuses, most programs were delivered from a central location. The institute had an emphasis on part-time and flexible delivery, with a strategy in place to increase online delivery. The institute had developed substantial video-conferencing facilities, to service this strategy better. It was noted that information technology constituted the largest growth area for this institute in terms of capital investment, number of staff and new developments.

Interviews were conducted with:

- one Deaf student
- a disability officer who was responsible for organising support for all students with disabilities within the institute
- one teacher who has taught the student
- one head of department

Student profile

Van

Van was born Deaf and uses Auslan as his primary language. He is the only Deaf student in this particular course and uses Auslan interpreters in the classroom. One problem he encounters is that the institute that he attends cannot provide sufficient funds for a Deaf student to be able to attend classes for a full-time course. As a result, other funds have to be sourced to pay for interpreters to enable to him to continue his studies.

Van had to undertake special classes to improve his written English before taking up further studies. Though his previous schooling provided him with an ability to communicate effectively, it did not include being able to write English effectively.

> *I knew I had English literacy problems … speaking English was fine but reading and writing was a big problem. I was amazed, because through ten years of primary and secondary school I wasn't taught English properly, yet after six months of the TAFE course I could write quite well.*

In the early days of his course, he developed the highly effective strategy of making long lists of words (especially technical language) that he did not understand, and later spending hours in a one-to-one situation with a tutor developing his own compilation of written definitions.

> *I developed my own programming dictionary, with my own definitions in it, which are cross referenced with the actual definition. In the second year I had my own* English as a Second Language *dictionary. That's a very good book. Now I use that dictionary a lot.*

Van is studying a higher level TAFE course with the aim of achieving a satisfying level of employment.

> *So I thought computing would be good for me because I knew it was a growing area.*

While Van studies in a sympathetic environment, the institute-level support person has a very broad role which is not only dedicated to the needs of Deaf and hard of hearing students. Van has found that he needs to be assertive to achieve the level of support he requires for success. He uses the disability support person only to book interpreters.

Van finds that the effective use of an electronic whiteboard by a teacher is extremely helpful, as it gives him the confidence that he can go over a class outline printed directly from this source. This allows him to concentrate on the interpreter more effectively and not fall behind in understanding what is happening in the class. He has found the provision of note-takers unsatisfactory, as this is usually another student not expert in the taking of notes professionally for a Deaf user.

> *Because they are their own notes and they write them from their own point of view.*

Van is very keen to work with information and communication technologies. He sees them as providing him with long-term, satisfying career opportunities, rather than being restricted to process type work, which has traditionally been seen as appropriate for Deaf and hard of hearing people.

Van uses email for both professional and personal communication. It particularly assists him to overcome communication difficulties in the workplace. He believes that email is difficult for Deaf people who do not have good English skills. Though he uses the Internet to keep informed professionally and for study purposes, Van is not able to afford to buy the level of technology required for home use of Internet and email. This would be highly desirable for both study and for social purposes.

Van looks forward to the time when bandwidth is adequate for video-conferencing. He believes that video-conferencing will assist Deaf students to study more effectively.

It would mean that you wouldn't actually have to go to a lecture. If a Deaf person had a paper in written English [then] they could show the interpreter, through video-conferencing, and have them interpret it into a more understandable form.

Van is excited about the longer term possibilities that technology will offer to improve communication and information access for Deaf people.

Information needs to be visual ... that's the best solution. Maybe in the future we will have VRLM (Virtual Reality Markup Language). It's like you're walking into a room and seeing something on the computer ... its visual.

Institute profile

The TAFE institute that Van attends is limited in the level of support that it can offer due to a State policy which restricts the allowance for interpreters and note-takers to a part-time allocation for each individual. The support person works across the institute for all special needs groups and therefore is not always able to provide the level of support he would wish to individual students. The support person was aware of the value such things as video-conferencing and videotape recording of lectures could have for Deaf and hard of hearing students. There was considerable professional development activity for institute staff about being inclusive of all students.

The support officer felt there were not enough resources available properly to brief teachers with Deaf and hard of hearing students about appropriate communication strategies and how to work effectively with interpreters. Indeed, there was some concern about the use of inappropriate teaching methods that would disadvantage Deaf and hard of hearing students.

Other Deaf people I know will just sit there and accept it. But I don't. Too bad for the other students ... they'll just have to wait until I'm satisfied that I understand what's going on.
(Deaf student)

The institute finds providing support for Deaf and hard of hearing students very costly. In effect, supplying interpreters for the communications needs of Deaf and hard of hearing students means paying a person each time the student needs to attend a class. This is unlike other special needs groups where support may be in the form of a one-off purchase of a piece of equipment or alteration to a building. The only economies for interpreter support could come if a group of Deaf and hard of hearing students chose to undertake the same course which is a highly unlikely scenario.

However, the institute has been very positive in trying to understand and support the needs of Deaf and hard of hearing students and has been willing to supply affordable technology such as electronic whiteboards which greatly assist students with note-taking. However, the greater expense of providing data projectors was seen as impossible to resource. There was also an understanding of the emerging issue of the difficulties faced by Deaf and hard of hearing students, with the introduction of data projectors now having to focus on three or four sources of information—their computer, a slide presentation, the teacher and the interpreter.

But while the instructor is talking, the non-Deaf student is listening and looking at the screen but the Deaf student can't do that because they are looking at the interpreter.
(Computer studies teacher)

There was a positive approach to personal communication via email on the part of the support officer. He was dissatisfied with the use of fax as a private and confidential means of communication and preferred to use email for its efficiency and greater level of privacy.

Case study 3

This case study was located in a second and much larger metropolitan TAFE institute with over 30 000 students. A key feature of the institute was its emphasis on providing flexible learning opportunities.

Interviews were conducted with:

- two Deaf students
- one teacher who had taught one of the Deaf students interviewed
- a disability officer who was responsible for organising support for all, students with disabilities within the institute
- one head of department

Student profile

Vaska

Vaska was born Deaf and uses Auslan as her primary language. Interpreters are provided by the institute in order for her to access classroom communications. She was educated in an oral environment, with an emphasis on learning spoken English, with the result that her English literacy skills are weak and have made it difficult for her to study.

> *I feel frustrated—I try to improve and do my best but in my mind I'm still frustrated with English.*

She often experiences difficulties expressing herself in English. Teachers may not understand what she means when she writes something down that she could more easily say in Auslan.

> *I do believe that in exams I should be able to explain myself in Auslan rather than writing it down in English.*

Vaska is the only Deaf student in the group. She is studying a middle-level TAFE course with the aim of achieving a satisfying level of employment. She sees that having skills in the use of technology will provide her with long-term career opportunities.

> *I worry about the future—will there be a job for me?*

However, in classes in which she is working with computers, she often experiences difficulty in following what is happening because of the need to focus on the computer as well as the interpreter and the teacher.

> *... because if I use a computer in class I try to watch the interpreter and the overheads, take notes, all at the same time, it's impossible. I haven't got four eyes.*

She believes that using computers to type up assignments has helped to improve her spelling and grammar skills. The spelling and grammar checkers provide her with a self-help facility that she is confident using.

Vaska does not have access to email but understands its use. She desperately wants to use it for both personal and study purposes. While she has an understanding of Internet chat technologies and sees them as highly desirable, she is not able to afford to buy the level of technology required for home use and does not have access to these facilities at her institute.

> *... if I had one (a computer) at home I could use it to type my assignments and I could email my friends, and maybe I could use chat with my friends in other parts of the State.*

Institute profile

This large multi-campus TAFE institute provides support to Deaf and hard of hearing students via a disability officer. There is an institutional emphasis on developing flexible

delivery systems that meet the needs of individual students. One of the hard of hearing students interviewed was taking advantage of this system and was content to access a flexible learning centre with limited face-to-face delivery. His belief was that he was becoming a more independent learner in the process.

Institute support for Deaf and hard of hearing students comes mostly in the form of provision of interpreting. Disability officers at the institute did not consider using technologies such as data projectors or electronic whiteboards that might alleviate communications barriers for Deaf and hard of hearing students in a hearing environment.

Case study 4

The final case study was located in another large metropolitan TAFE institute with an enrolment of around 60 000 students. There was a high level of expertise in vocational training for Deaf and hard of hearing students. The institute organised niche-access programs specifically for Deaf and hard of hearing students to develop English literacy, numeracy and technology skills and around 50 students are enrolled in these courses on two campuses. These programs had an access emphasis and aimed to encourage students to attempt further training in other parts of the institute.

Interviews were conducted with:

- one Deaf student
- one teacher who had taught the Deaf student
- one head of department

The disability officer was not interviewed as she had no involvement with the program.

Student profile

Caitlyn

Caitlyn is Deaf and uses Auslan as her primary language. She was educated in a signed English environment. She wants to study English in order to be able to participate in further education or training. She attends niche English classes for Deaf and hard of hearing students at a TAFE institute in order to do this.

> *... it was really difficult for me to study (in the mainstream) and I was always lagging so far behind.*

Caitlyn is employed, but would like to be able to study to develop further career options. She would not be able to study without the assistance of an interpreter and note-taker. She has a computer at home and would like to be able to use the Internet and email but is unable to afford to purchase a modem and to pay for the ISP costs for this facility.

Her main experience in the use of learning technologies has been through the use of a data projector by her teacher in her English class and the computer training she has done in a niche class for Deaf and hard of hearing students.

The teacher uses the data projector as a teaching tool, enabling students to type in words and sentences that can be instantly shared with the whole group for revision and reinforcement. The advantage, she says, is that all students can see each other so that they are sharing Auslan and having it immediately translated into English by the teacher or other students for all to see.

> *The data-show shows us precise English and we can [see] from that. The teacher types in English words what we have said in Auslan. We can see the equivalent meaning in English. I feel that it has improved my English a great deal.*

Caitlyn's other experience of technology is in the training to use computers. Again, this training is completed in a niche class for Deaf and hard of hearing students with the aim of developing basic skills that would enable her to undertake higher level studies or just use computers for personal purposes. She finds the way in which computer laboratories are designed makes it very difficult for students who use sign language to communicate with each other and thus reduces their chances of working together. She finds the environment quite limiting and not 'Deaf friendly' for learning purposes.

> *I get quite frustrated with computers because it's very difficult to see around the computers and to see what discussions are taking place in the class with other Deaf. I find it really very obtrusive and I wish it was out of the way. The data-show is quite good because it's open; you can see everybody and you can see what the teacher or other students are typing up. There are no barriers in that situation.*

Institute profile

The TAFE institute in this case study runs niche programs for Deaf and hard of hearing students. Over time, the institute has worked at developing programs that will attract these students and give them foundation skills that will enable them to proceed to mainstream vocational training. It has a particular emphasis on English literacy programs and basic computer-skill programs. Students are taught in niche classes for Deaf and hard of hearing students with teachers who are skilled in Auslan and can teach students in their own language.

The department manager responsible for the special classes is very supportive of the needs of Deaf and hard of hearing students but there has not been any planned spending of funds for more equipment for use by these students. However, the purchase of a portable data projector with a laptop for the department has given the teacher working with the Deaf students the opportunity to develop some innovative teaching techniques that have been very well-received by the students.

Initially, all teachers in the faculty were given some basic training on how to assemble and use the equipment. Training was also provided in appropriate software applications such as Power Point. The teacher working with the Deaf and hard of hearing students has used these skills to design lessons creatively in order to improve the English literacy skills of the students.

Primarily, she used it as a way of projecting written English for the whole group to see. Later, she realised that it would also serve to project resources such as encyclopedias on CD-ROM that could be shared by the whole group for language and literacy development. The teacher was able to type words or sentences into an application such as Microsoft Word or PowerPoint at a very high font setting so that all class members could see the projection instantly. This sort of sharing had previously been done writing the words on paper which would then be held up for all to see; a method that was found to be cumbersome and which did not allow easy exchange of language and reinforcement or correction for students.

Use of this equipment has been extended to giving students access to multi-media resources on CD-ROM. Pages are displayed on a screen and students are able to translate or see the teacher translate written language in front of them. It has also exposed learners to resources and information that they may not otherwise have used. This is regarded as a very 'Deaf friendly' approach to classroom learning by the students as it allows free flow of communication between students and the open sharing of language in translation.

3: Technology issues

Findings from all case studies have been synthesised below. These findings include types of technology currently being used, the benefits of using such technology, the barriers encountered, issues for technology use, VET system issues and the key issues identified.

Technology used by Deaf and hard of hearing students

Table 2 below gives an overview of technology which was found to be used by Deaf and hard of hearing students in the case studies.

Table 2: Use of technology by Deaf and hard of hearing students in TAFE institutes

Technology used	How used	Context used	Reasons to use	Student outcomes
World Wide Web (www)	❖ Learning to access and navigate ❖ Individual using library or computer laboratory for research purposes	❖ Individual or in class ❖ In niche classes for Deaf and hard of hearing students and in niche classes for students with a range of disabilities	❖ To find information ❖ Foundation studies to prepare students to study in mainstream classes	❖ Participation in a wide range of training programs ❖ A sense of being able to access current information independently
Chat	❖ To communicate between students in the classroom	❖ In niche classes for students with a range of disabilities	❖ To introduce the concept of using online chat facilities	❖ Greater awareness of Internet facilities ❖ Literacy through the use of text
Email	❖ To communicate with Deaf and hard of hearing students	❖ Teachers and disability officers in niche classes for students with a range of disabilities ❖ Disability officers—contacting students	❖ Fast, efficient and private means of communicating with students ❖ Quicker than fax to discuss need for interpreters, and make changes in programs	❖ Improved level of communication ❖ Improved level of confidentiality in communication between TAFE and Deaf society

Table 2: Use of technology by Deaf and hard of hearing students in TAFE institutes (cont.)

Technology used	How used	Context used	Reasons to use	Student outcomes
Personal Computer	❖ Information and communication device and for applications word processing, spreadsheets Internet and email	❖ Deaf students in niche classes for students with a range of disabilities ❖ Specific subjects in the IT certificates	❖ Appropriate device ❖ Part of course	❖ Essential technology skills for participation in both training and the workforce ❖ Qualification in computing ❖ Ability to undertake further training ❖ Empowerment ❖ Improved language skills achieved by use of grammar and spelling
CD-ROM	❖ Delivery of content via multi-media program	❖ Flexible learning program	❖ Resources for course work delivered this way	❖ Achieved greater mastery of content due to opportunity to revise materials
Electronic whiteboard	❖ Accessing teacher's notes from the board	❖ In mainstream classroom	❖ Ease of watching the interpreter without having to take notes at the same time	❖ Improved understanding of class review afterwards

Benefits gained from using technology

The main benefits arising from the use of technology with Deaf and hard of hearing learners are:

- increased ability to use information technology either for improving employment options or to create opportunities for further study within a mainstream environment
- increased amount and quality of visual information able to be offered in the classroom
- increased communication options between teachers and students via the use of email
- greater privacy being afforded to students through email as opposed to faxing of communications to machines with wider unprotected access
- greater comfort with communication process via email which does not require higher writing skills
- increased confidence through being able to take more control of their own learning through flexible learning centres
- ability to revise materials stored on CD ROMs, in their own time and at their own pace
- improved English literacy and grammar skills by use of grammar and spelling checkers and increased opportunity to compose text
- facility for immediate visual feedback in classrooms via data projectors

Barriers to the use of technology

A number of barriers were identified from the case studies.

- The complexity of language and navigational approaches generally found in web pages creates difficulty of use for learners with low language and literacy attainment.
- With increased visual input there can be a difficulty of having to watch the computer screen, the interpreter, the overhead projector (or data-show) and the teacher at the same time. This requires a careful monitoring and understanding by the teacher of the direction and speed of information flow in the classroom.
- At higher levels, there is sometimes difficulty in coping with complex texts specific to the use of technology and with highly technical language.
- The physical layout of computer labs is often not sympathetic to the communication needs of Deaf and hard of hearing students, thus creating barriers that inhibit communication conducted via Auslan.
- There is no routine way of informing Deaf students of learning technologies available for them on campus.
- The cost and maintenance of technology inhibits institutions in resource-tight environments from purchasing this equipment even when demonstrable advantages can be given.
- Teachers need to be trained in the use of technology so that they feel confident in how to use such equipment creatively.

Issues for technology use

- Developing an awareness of appropriate teaching strategies is critical when Deaf students are present in class, including use of highly visual support materials that can be presented via data projectors. This could be in the form, for example, of the ability to use presentation applications such as Power Point and to be able to set up and use data projectors for the benefit of Deaf and hard of hearing students.
- Video-conferencing and video relay interpreting (VRI) are seen as highly desirable by Deaf students but, at current affordable bandwidths, transmission delays disturb the flow of Auslan, thus making it impractical. However, planners must be prepared to consider such technologies that are seen by learners as a way of achieving more equitable outcomes by this group.
- The potential of VRI should be investigated by educators at a national level for its potential to alleviate the costs and shortages of accredited interpreters across Australia.
- There seems to be a lack of awareness by teaching staff of the benefits of using technology with Deaf students in contrast to using technology with other equity groups such as visually impaired and physically disabled students. There is a need to promote the possible improved communications outcomes for Deaf and hard of hearing students that can be achieved with increased technology use in the VET sector. There is a need for planners and policy-makers to be more aware of how these technologies can best be used by Deaf and hard of hearing students.

VET system issues

- There is a lack of awareness by practitioners of the potential value of the appropriate use of technology in teaching situations for Deaf students which indicates a need for improved professional development in this area.
- There does not seem to be a general awareness of the needs of Deaf students who are often not assertive enough to approach teachers and lecturers for assistance. This often results in students withdrawing or at best falling behind the rest of the group.

- There seems to be a general lack of awareness that language literacy issues are the major inhibiting factor for Deaf students achieving equitable outcomes as learners in VET. This results in the issue of Deaf communication needs being treated as a disability, not as a language and cultural issue.
- Deaf and hard of hearing students strongly believe that increased access to technology, both at home and on campus, will help them with the particular communication needs that they have. They believe greater access to computers will lead to their increased participation in education and training.
- Where flexible learning is available, there is a need to determine the appropriate support for Deaf and hard of hearing students.
- Where flexible learning is the only available mode of delivery, training providers should take care that Deaf and hard of hearing students with literacy and numeracy needs are given support that will enable them to access these courses.

Learning issues

- There is a need to assess language and literacy levels of students undertaking flexible and online training options and to ensure that materials developed for this medium are written in appropriately plain English and accessible for a range of learning styles.
- Availability of email for Deaf and hard of hearing learners is highly desirable both for study and social communication purposes. It provides a way of achieving rapid and confidential exchange of information for both 'Deaf-to-Deaf' and 'hearing-to-Deaf' situations.
- The high cost to students of purchasing computer equipment and Internet connection for home study is prohibitive and limits the opportunity to capitalise effectively on the benefits gained by its use.
- There is a need to understand more fully appropriate room layout for Deaf and hard of hearing students when in computer classrooms, particularly when using data projectors as a source of information. Improved information could be used to improve teacher practice when they have Deaf and hard of hearing learners in their classrooms.
- There is a need actively to identify technology applications that will improve equity outcomes for Deaf and hard of hearing learners by overcoming communication problems. Technologies identified in this study that have the potential to achieve this are video-conferencing and voice-to-text technology.

4: Findings and recommendations

This project has focussed on building a picture of technology use by Deaf and hard of hearing students in four TAFE institutes across Australia in order to draw some conclusions about the effectiveness of, and barriers to, that use. Policy documents from both State and federal education authorities stress the importance of creating a training system that follows world's best practice in providing vocational education and training outcomes for learners in a range of equity groups. However, there have not been any studies monitoring such practices for Deaf and hard of hearing students. While this study had a very narrow focus on technology use, it was inevitable that other issues would be raised that would contribute to a wider picture of the experience of Deaf people in VET.

In particular, the issue of the inadequate language and literacy skills of Deaf and hard of hearing students came through all the interviews, particularly with Deaf students, as an underlying issue in any discussion about use of technology to enhance teaching and learning opportunities. There have been rapid advances in the use of information and communication technologies in both education, work and in the wider community. The potential for these technologies to enhance participation by Deaf and hard of hearing people in the VET system has become clearer as a result of this study. But it appears that unless the issues of access to technology and support for Deaf and hard of hearing learners are not combined at all levels, with action to address their language and literacy needs, most of these students will continue to suffer disadvantage in achieving equitable outcomes in the VET sector.

> *I honestly believe it would advantage most Deaf students if we could provide them with one-to-one or small group tutoring on a regular basis, whether once a week or fortnight to pick up issues like English language support or any other issues that they're having with their study ... but that's not technology.* (Disability support officer)

In line with the objectives of this study, the following findings and recommendations are presented according to each of the stakeholder groups involved in the study:

- students
- teachers
- managers
- the VET system as a whole

For Deaf and hard of hearing students

Language and literacy issues

> *It's hard for someone who needs an interpreter. Some other teachers and students try to write notes to Deaf people on paper and many Deaf people don't understand those notes.* (Deaf student)

As detailed earlier in this report, most Deaf students use English as a second language. Therefore, when they come to use resources that display written English, whether it is via the World Wide Web, CD-ROM or the printed page, an immediate barrier is presented for the learner. All the Deaf students interviewed raised this issue as one high in their consideration

of successful use of technologies. One student had to go through a very elaborate and time-consuming process of developing his own translation of technical terms when studying a computer-programming course. Other students relied heavily on a plain English version of notes developed by a specialist teacher for that purpose when undertaking a computer-training course.

High cost of access to technology

Interviewer: *Do you use the Internet a lot?*

Deaf student: *A bit. It costs money though, so I have to be careful.*

Again, all students commented on their frustration at having limited access to email and the web because of the cost of providing them both at the institute and at home. One common desire of students was to have access to email so that they could consolidate skills learned in the classroom and more effectively communicate with fellow students and their teachers. There was a high level of awareness of the value of both email and of the web, but a feeling that it was beyond their means to purchase the PC. The costs of maintaining an Internet service provider account for its ongoing use were frequently prohibitive.

Teaching methods

The need to change focus (to watch the interpreter, teacher and computer screen at the same time) means the Deaf students have to work that much harder than the hearing students who are able to listen to the lecturer and do the exercise at the same time. (Disability support officer)

I get frustrated with computers because it is difficult to see around the computers and to see what discussions are taking place in the class with the other Deaf. I find it really very obtrusive and I wish it was out of the way. (Deaf student)

Interviewees often spoke of the difficulty of being a learner with a teacher who did not take into account the specific communication needs of Deaf and hard of hearing students in classrooms.

The presence of both computers and data projectors in classrooms has presented students with a new set of communication problems that can further disadvantage their full participation in the learning process. In the traditional classroom, most teaching methods will use both visual and aural input at the same time. This places the Deaf and hard of hearing student at a great disadvantage as they may be faced with up to three points on which they must focus in order to follow the lesson. When a visual presentation is being used in face-to-face lessons, Deaf students must watch the interpreter as well as the visual display. They may also have to focus on a computer screen at the same time. Therefore, teaching strategies need to be inclusive of Deaf students who have to wait for classroom dialogue to be interpreted by a third party. Unless teachers are aware of this, they may be unconsciously denying Deaf and hard of hearing students equitable access to information.

Lack of appropriate classroom support

Sometimes we didn't get the interpreters we booked, sometimes they just didn't arrive or we changed rooms. To actually get one was a major effort. (Teacher of computer studies)

I believe the staff have not been well trained in the use of interpreters ... they're uncertain how to relate the student to the interpreter. (Disability support officer)

The issue of learner support was recognised by most interviewees in the study as one that did impact on the ability of Deaf and hard of hearing students to gain equitable access to education and training opportunities. Funding in one institute was not available for Auslan interpreters for students who wished to study full time. This situation resulted from an arbitrary State training authority policy decision. It meant that the student was forced either to study part time or to top up interpreter expenses in some other way. In another situation a

student was not provided with a qualified note-taker for Deaf and hard of hearing students, but had to accept the notes of another student which meant nothing to him.

Provision of appropriate classroom support has a range of dimensions that compels managers, teachers and support staff to understand the specific communication needs of Deaf and hard of hearing learners. In particular, teachers need to know how to work with an interpreter and how to pace the communication process to take into account the time required for interpreting to take place. They should understand the need for the Deaf and hard of hearing student to change focus to be able to follow classroom demonstrations and the dialogue that might accompany them. This expertise did not appear to be available in most of the institutes surveyed. In fact, at the time of the initial survey it was difficult to identify support people in most institutes who felt they had adequate knowledge of the needs of Deaf and hard of hearing students to participate in the case study stage of the project.

As noted earlier, specific support for Deaf and hard of hearing students is usually provided by note-takers and Auslan interpreters. However, the increased use of technology in classrooms has further complicated the flow of communication, thus requiring teaching staff to have a more detailed understanding of how to manage the communication process in a more complex environment. The very real possibility is for the presence of technology to compound the disadvantage that many Deaf students already experience in the classroom.

Recommendations

Recommendations are made on the basis that they are applied to all TAFE institutes where Deaf and hard of hearing students are enrolled so they have an increased opportunity to access available technology.

There is a need to:

- provide learning materials that are prepared/customised specifically for Deaf and hard of hearing students to take into account their specific language and learning needs
- ensure that Deaf and hard of hearing students have access to adequate interpreting and note-taking support to enable them to undertake the study options that best suite them
- investigate ways of providing Deaf and hard of hearing students with adequate access to learning technologies, both in institutes and at home, which will better enable them to achieve equitable outcomes in education and training
- undertake a study to investigate appropriate room layout and design (especially in relation to computer laboratories) to suit the needs of Deaf and hard of hearing learners

For teachers of Deaf and hard of hearing students

Lack of professional development which would lead to an improved understanding of Deafness

... and we don't have enough money or time (for professional development) in the main because of productivity issues for staff development in the content area, let alone the process areas. The technology staff find it very difficult. (Teacher of computer studies)

I would expect that the student make a major effort to read. I did suggest to her to read ahead. But I never thought (that she may have trouble reading.) She seemed bright and quite aware. And I thought she would be able to read ahead. But I didn't succeed in encouraging or coercing or bribing or whatever to get her to do that ... to compensate. (Teacher of computer studies)

... all the staff have been through a training program in the general area of disability ... they discussed issues such as using toilets, stairs, accessing lifts and rooms.
(Manager computer studies dept.)

... generally speaking, hearing people don't have a good understanding of Deaf culture.
(Disability support officer)

One teacher indicated that he had experience teaching disabled students and had found that they could usually manage to keep up. This teacher believed that there was no additional knowledge needed to work with these students but that if they were sufficiently motivated they would find a way of working out their difficulties. This more extreme case illustrates the common problem of identifying Deaf and hard of hearing students as ones who have a communication limitation rather than a physical limitation. It also highlights another, but significant, barrier which may be faced by some students with additional needs; their additional support needs are not recognised and their difficulties are seen as a lack of motivation to succeed. People such as the computer studies teacher quoted above see the student as the problem, rather than looking at their own attitude towards the student and their own understanding of issues which the student is facing.

The quotes above illustrate how a misunderstanding about Deafness can lead to inappropriate responses to students. Implications for the learner can be failure to identify appropriate approaches for working with individual Deaf and hard of hearing learners. Teachers need to have an opportunity to learn that when are they are working with Deaf and hard of hearing students, communication and language barriers are the most important issues to consider. There is a critical need for them to develop the skills to work in an inclusive way with note-takers and interpreters to ensure that learners are not deprived of essential information. It is also vital that teachers in general explore their own attitudes towards, and understanding of, students with special needs.

Lack of skill with technology

Well, you are speaking to a total ignoramus because I can't use it [the data-show]. I don't know how to use it and don't know anything about it. (Manager)

Teachers and their supervisors themselves may lack training in the use of available technologies which might provide Deaf and hard of hearing students with improved opportunities in the classroom.

Lack of resources to acquire technology that will improve learning environments for Deaf and hard of hearing students

I have to actually book the equipment, bring it to the classroom, set it up and take it back to where it belongs afterwards. It's quite expensive equipment. It can be heavy and sometimes I take the students with me to help me carry it back. I am worried about damaging it.
(Teacher of Deaf students)

In this case a teacher was talking about a data projector which had revolutionised her approach to English language development for her Deaf students. However, these students still had the same priority level for use of this equipment as other students in the institute and were forced to share the equipment. Lack of funding to purchase additional data-show projectors means that at times the data projector will be booked for other classes and Deaf students will miss out.

Recommendations

Rationale for recommendations

Recommendations for students are made on the basis that they be applied in all TAFE institutes where Deaf and hard of hearing students are enrolled, so that teachers become more aware of the needs of Deaf and hard of hearing students and they have increased opportunity for access to the curriculum.

There is a need to:

- increase teacher awareness and training in the use of technology best suited to Deaf and hard of hearing learners through professional development
- increase teachers' awareness of the importance of providing appropriate room layout sympathetic to the learning needs for Deaf and hard of hearing students in computer rooms
- develop a checklist for best practice use of technology with Deaf and hard of hearing students
- develop and publish best practice models of delivery to Deaf and hard of hearing learners using technology

For managers

The invisibility of Deafness means that managers can easily overlook of the needs of Deaf and hard of hearing students

> *There are three (Deaf students) that I am aware of in one course and, accidentally, I found a hairdressing apprentice yesterday who's actually hearing impaired.* (Student support person)

The issue of Deaf and hard of hearing students not making themselves known to support services arose a number of times throughout the project. There may be a number of cultural and personal reasons why this is so. However, education and training organisations may also need to assess the way in which they promote support services at the point of entry, and also at later stages when students may be experiencing difficulties in completing course requirements. Having to approach a service that emphasises disability may discourage many students who may assume support will not be appropriate to the needs of Deaf and hard of hearing learners.

Lack of awareness of the resourcing implications for supporting Deaf and hard of hearing learners to ensure equitable outcomes

> *Q: Who pays for the interpreter?*
>
> *A: We have a State-funded disability program that assists in those sorts of functions. It's probably been internally funded through a couple of functions within the department, but we haven't actually identified costs.* (Department manager)

Support for Deaf and hard of hearing learners is resource intensive. One manager lamented that there was no way of achieving economies of scale by locating clusters of two or three students requiring interpreter and note-taking support in classes. Another manager regarded issues for Deaf and hard of hearing learners as simply disability issues. That is, he felt that as staff had undergone training in such things as assisting disabled learners to locate toilets, lifts and access ramps that this would be sufficient preparation for working with Deaf and hard of hearing learners. This approach represents a common failing by institutes to undertake a critical examination of the implications of what would be required to provide appropriate support for these learners. There was a failure to understand and respond to the communication problems experienced by Deaf and hard of hearing learners in a hearing environment.

Where technology had succeeded in overcoming some of the communications difficulties (as with the use of the data projector), it had not been recognised as anything other than one teacher being very innovative. No further extension of this sort of use had been contemplated, nor had there been further investment in equipment to extend the model.

Lack of understanding that the quality of support provided to Deaf and hard of hearing learners was critical to their success in accessing and completing courses in VET

> *Because they are their own notes they write them from their own point of view. Sometimes the notes help me to remember what has been discussed but if they think some of the information isn't key information that they don't need it, then they won't write it down.* (Deaf student)

The quality of support available was an issue for Deaf students. Using a hearing student in the same class to take notes for the Deaf learner was not seen as adequate support. By contrast, one institute gave the note-taker a broad role in which she worked with the teacher before the class took place to find out what teaching methodologies would be used. Once this had been done, she advised the teacher of appropriate approaches that would enable the Deaf student to participate fully in such things as group activity, assessment processes and in general be able to follow the lesson with a minimum of confusion. This approach resulted in a high level of satisfaction for the student who felt well-supported and able to operate successfully in a hearing class.

One Deaf student was regarded as very successful because of his ability to be assertive about his needs. However, he commented that when he came across an unsympathetic teacher he 'could not be bothered approaching her about it'. This situation highlighted the vulnerability of the individual trying to achieve equity. Another student reported that he became so frustrated by the difficulty of getting Auslan interpreters to lessons that he had to withdraw from that particular course. These difficulties arose for a number of reasons, such as a shortage of interpreters, or timetable changes that meant interpreters may not have been available at that time or replacement interpreters may not have had adequate skills to deal with the content of the lesson.

Recommendations

Rationale

Recommendations for managers are made on the basis of being applied to all TAFE institutes so that the needs of Deaf and hard of hearing students are better understood by institute management.

There is a need to fund nationally based information programs which will inform institute managers of how they can better meet their obligations under access and equity legislation for Deaf and hard of hearing learners by:

- preparing targeted orientation programs which will, as well as providing general student information, make Deaf and hard of hearing students aware of technology services provided by the institute
- providing adequate resource allocation for both interpreting and note-taking support

Further, there is a need to:

- develop specifically for dissemination at manager level, best practice models for use of technology that will improve overall equity outcomes for these learners
- develop and deliver professional development programs that will raise awareness among managers of the specific needs of Deaf and hard of hearing learners so that they are better able to inform their staff of the needs of these learners, and be able to make well-informed resourcing decisions to improve education and training outcomes for Deaf and hard of hearing students

For the VET system

The need to investigate and trial technology which may ensure equal access for Deaf and hard of hearing students to education and training in VET

> *If a Deaf person had a paper written in English that they couldn't understand, then they could show the interpreter, through video relay interpretation, and have them interpret it into a more understandable form.* (Deaf student)

Throughout this investigation a number of technologies were either suggested, or seen in action, which appeared to have the potential to improve access to training for Deaf and hard of hearing people. There exists a need to undertake some detailed studies that could be used to inform investment in these enabling technologies.

Some examples that could be considered for further investigation are:

- the data projector, which appears to bring a highly visual Deaf friendly communication tool to the classroom context
- video relay interpreting of lectures for concurrent or later viewing by learners
- PC use in classroom
- chat and email as efficient communication tools
- use of groupware[1] products to encourage online synchronous and asynchronous communication for learners
- the use of real-time captioning to enable Deaf students to read classroom communications as they are spoken

There is a need to identify and distinguish technology resourcing issues that apply to Deaf and hard of hearing learners as distinct from disability groups

The distinction between the needs of Deaf and hard of hearing learners and other special needs groups was not well-recognised by teachers, managers and support personnel in general. The tendency to fail to identify the specific communication needs of these learners often appears to lead to a failure of training providers to fulfil their obligations under equal opportunity legislation. In a technologically driven learning environment, there is a need to review the specific obligations of education and training providers as they apply to Deaf and hard of hearing learners. Such a review should lead to the development of strategies of better technology use that will improve access to education and training.

Recommendations

Rationale

Recommendations are made on the basis that they be applied at the management level to incorporate better the specific linguistic and cultural needs of Deaf and hard of hearing students in future planning of resources.

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[1] Groupware is software that combines a range of tools that enables access to a range of communication options such as threaded messages, email and chat within the one package

There is a need:

- for ANTA and all State and Territory VET authorities to take into account, and make provision for, the specific needs of Deaf and hard of hearing students when they are making decisions to fund online and flexibly delivered course materials
- to fund trials that are designed to evaluate the appropriateness and possible uses of new technologies for Deaf and hard of hearing students, and for provision to be made for the findings from these trials to be distributed to the VET system. In particular, trials of video relay interpreting, video-conferencing and voice-to-text technologies should be conducted in relation to its possible use in educational settings

I will maybe hear from you again one day, and see what happens with your report. I'm very interested in your research for Deaf people. It's very good. I like to help and it's good that you came.
(Deaf student)

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Attachment 1

Table A1: Module enrolments for clients with a hearing disability by discipline by qualification for Australia 1999

	AQF diploma or higher	AQF certificate IV or equivalent	AQF certificate III or equivalent	AQF level unknown	AQF certificate II, certificate I & senior secondary	Other	Total
01 Humanities	581	349	903	125	1 676	443	4 077
02 Social studies	607	243	125	29	65	80	1 149
03 Education	121	208	140	11	135	181	796
04 Sciences	167	85	239	46	460	115	1 112
05 Mathematics, computing	1 703	913	1 878	323	1 510	1 387	7 714
06 Visual/performing arts	605	296	388	60	384	175	1 908
07 Engineering, processing	699	453	1 542	290	1 120	717	4 821
08 Health sciences	1 087	522	2 013	146	1 526	464	5 758
09 Admin, business, economics, law	1 862	1 321	2 702	478	2 051	1 024	9 438
10 Built environment	347	129	944	132	499	237	2 288
11 Agriculture, renewable resources	181	272	822	68	1 049	385	2 777
12 Hospitality, tourism & personal services	344	247	1 159	82	1 329	366	3 527
13 Social, educational & employment skills	496	467	1291	212	4 581	2 363	9 410
Grand total	**8 800**	**5 505**	**14 146**	**2 002**	**16 385**	**7 937**	**54 775**

Table A2: Clients by disability by State/Territory for 1999

	NSW	Vic	Qld	WA	SA	Tas	NT	ACT	Australia
Clients with a hearing disability	2 828	1 836	1 391	376	589	136	109	101	7 366
Clients with a disability	25 385	16 865	10 359	3 240	4 749	1 173	519	888	63 178
All clients	**534 315**	**476 263**	**306 514**	**126 412**	**133 931**	**31 810**	**19 282**	**18 652**	**1 647 179**

Table A3: Clients with a hearing disability by age group for Australia 1999

Clients										
Age 14 or under	Age 15–19	Age 20–24	Age 25–29	Age 30–39	Age 40–49	Age 50–59	Age 60–64	Age 65 or over	Age not known	**Total**
30	1072	853	629	1291	1581	1055	271	449	135	**7366**

Source for tables A1–A3: 1999 NCVER statistics (unpublished)

NCVER

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ISBN 1 74096 006 8 print edition
ISBN 1 74096 007 6 web edition